



[4459] – 112

Seat No.	
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**T.E. (Mechanical Engineering) (Semester – I) Examination, 2013  
COMPUTER ORIENTED NUMERICAL METHODS  
(2008 Course)**

Time : 3 Hours

Max. Marks : 100

- Instructions :** 1) Answer **three** questions from Section I and **three** questions from Section II.  
2) Answer to the **each** Section should be written in **separate** books.  
3) Draw suitable neat diagrams, **wherever** necessary.  
4) Black figures to the right indicate **full** marks.  
5) **Use** of logarithmic tables, Slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.  
6) Assume suitable data, if **required**.

**SECTION – I**

**Unit – I**

1. a) Find the positive root of  $x^4 - x = 10$  by Newton-Raphson correct to three decimal places. 8
- b) Use Simpson's 1/3<sup>rd</sup> rule to estimate following integration  $\int_1^2 \frac{e^x}{x} dx$ . 7

OR

2. a) Explain what is meant by Simpson's strip for 1/3<sup>rd</sup> rule and 3/8<sup>th</sup> rule ? Explain why Simpson's 3/8<sup>th</sup> rule give more accuracy compared to trapezoidal and Simpson's 1/3<sup>rd</sup> rule with same number of strips. 8
- b) Solve the equation to isolate x on left hand side for given function  $x^2 - x - 1 = 0$ , also explain following statement with graphical explanation "Successive approximation is more unstable method is more unstable method compared to Newton Rapson method to estimate roots of nonlinear equations". 7

P.T.O.



### Unit – II

3. a) Find the polynomial  $f(x)$  by using Lagrange's interpolation formula and hence find  $f(3)$  for the following series : 7

<b>X</b>	0	1	2	5
<b>F(X)</b>	2	3	12	147

And estimate  $F(X)$  for  $x = 3$  ?

- b) Explain procedure to estimate higher order interpolating polynomial by Newton's Forward Interpolation method. Draw a flowchart. 8

OR

4. a) Fit the data with first order splines, evaluate function at  $x = 5$ .

**X** : 3      4.5      7.0      9.0

**Y** : 2.5      1.0      2.5      0.5 8

- b) Use Newton's divided  $f(2)$  difference method to compute from the experimental data shown in table : 7

<b>x</b>	-1	0	0.5	1	2.5	3
<b>y=f(x)</b>	3	-2	-0.375	3	16.125	19.0

### Unit – III

5. a) Use Gauss Elimination method to find  $v_1$ ,  $v_2$  and  $v_3$  7

$$2v_1 - v_2 + 3v_3 = 5$$

$$-4v_1 - 3v_2 - 2v_3 = 8$$

$$3v_1 + v_2 - v_3 = 4$$

- b) Write a step by step procedure for Gauss Elimination method, develop a flow chart for Gauss-Elimination method. 8

- c) Explain following statement with graphical representation "Gauss Seidal method and successive approximation method are same and in both method intersections of lines is taken as a solution". 5

OR



6. a) Apply Gauss-Elimination method to solve the equations as follows : 8  
 $x + 3y + 3z = 16$   
 $x + 4y + 3z = 18$   
 $x + 3y + 4z = 19$
- b) Explain step by step procedure for Gauss Seidal method to compute solution of simultaneous equation and draw a flowchart. 7
- c) What is meant by Partial Pivoting in Gauss Elimination to solve simultaneous equations ? And explain its importance in convergence of solution. 5

SECTION – II

Unit – IV

7. a) Growth of bacteria (N) in a culture after t hrs. is given in following table : 8

T	0	1	2	3	4	5	6
N	32	47	65	92	132	190	275

Fit a curve of the form  $N = ab^T$  and estimate N when  $t = 4.5$ .

- b) Write down a step by step procedure for linearizing the exponential equation. Develop a flow chart for exponential equation. 7

OR

8. a) What is meant by Least Square Regression Method. Derive the relation for linear equation fit using least square approach. 7
- b) In some determinations of the value  $v$  of  $CO_2$  dissolved in a given volume of water at different temperatures  $\theta$ , the following pairs of values were obtained : 8

$\theta$	0	5	10	15
$v$	1.80	1.45	1.18	1.00

Obtain by the method of least square, a relation of the form  $v = a + b\theta$  which best fits to these observations. Also find the value of  $CO_2$  dissolved in a volume of water at the temperature  $25^\circ C$ .



### Unit – V

9. a) Using 2<sup>nd</sup> order Runge Kutta method solve  $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$  with  $y(0) = 1.0$  at  $x = 0.2$  and  $x = 0.4$ . 8
- b) What do you mean by Weight Average Slope over interval method in ODE solution? What is meant by 2<sup>nd</sup> order and 4<sup>th</sup> order Runge Kutta ODE methods? 7
- OR
10. a) Explain step by step procedure for Predictor Corrector Method to solve ordinary differential Equation and also develop a flow chart for the same. 7
- b) Apply Runge Kutta 2<sup>nd</sup> order method to find approximate value of  $y$  for  $x = 0.2$  in steps of 0.1, if  $\frac{dy}{dx} = x + y^2$  given that  $y(0) = 1.0$ . 8

### Unit – VI

11. a) Given the values of  $u(x, y)$  on the boundary of the square is as follows, evaluate the function  $u(x, y)$  satisfying the Laplace equation  $\nabla^2 u = 0$ . 12  
Boundary conditions,  
Top = 1000 ; Bottom = 500 ; Left = 2000 ; Right = 500 with 3×3 grid points.
- b) Explain Liberman's method to solve Partial Differential Equation. Write down step by step procedure. 8
- OR
12. a) Solve following systems of ODE and estimate values of  $y_1(1.0)$  and  $y_2(1.0)$  at with step size of 0.25. 12
- $$\begin{cases} \frac{dy_1}{dt} = -0.5y_1 \\ \frac{dy_2}{dt} = 4 - 0.1y_1 - 0.3y_2 \end{cases} \quad \begin{cases} y_1(0) = 4 \\ y_2(0) = 6 \end{cases}$$
- b) Write down step by step procedure for solution of PDE of Laplace Equation and develop a flow chart to write a program. 8